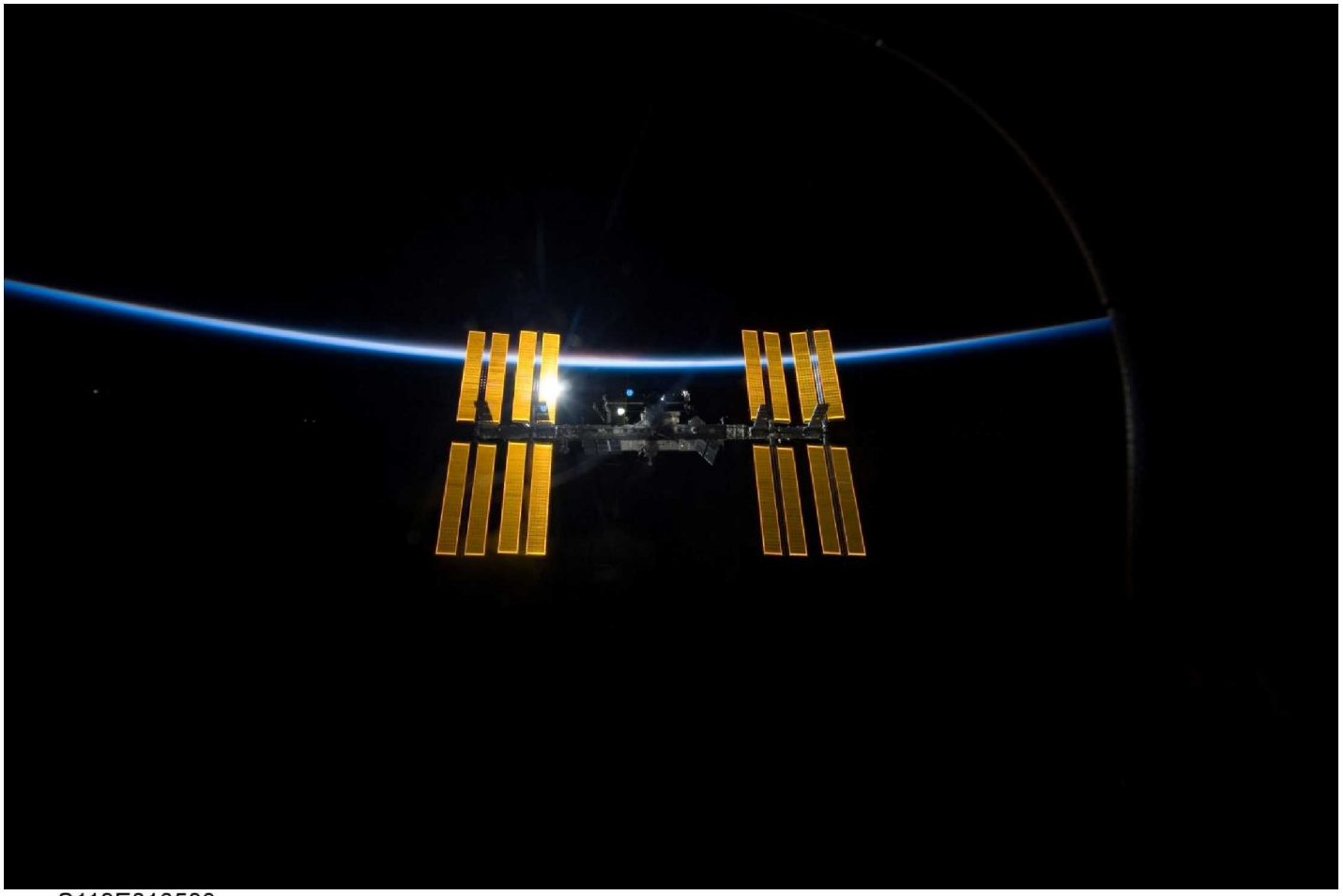
Right Ventricular Tissue Doppler in Space Flight

Kathleen M. Garcia, B.S.
Douglas R. Hamilton, M.D., PhD
Michael R. Barratt, M.D.
Ashot E. Sargsyan, M.D.
Douglas Ebert, PhD
David S. Martin, B.S.
Valery V. Bogomolov, M.D., PhD
Scott A. Dulchavsky, M.D., PhD
J. Michael Duncan , M.D.,

Space Normal Right Ventricle



S119E010500

Background

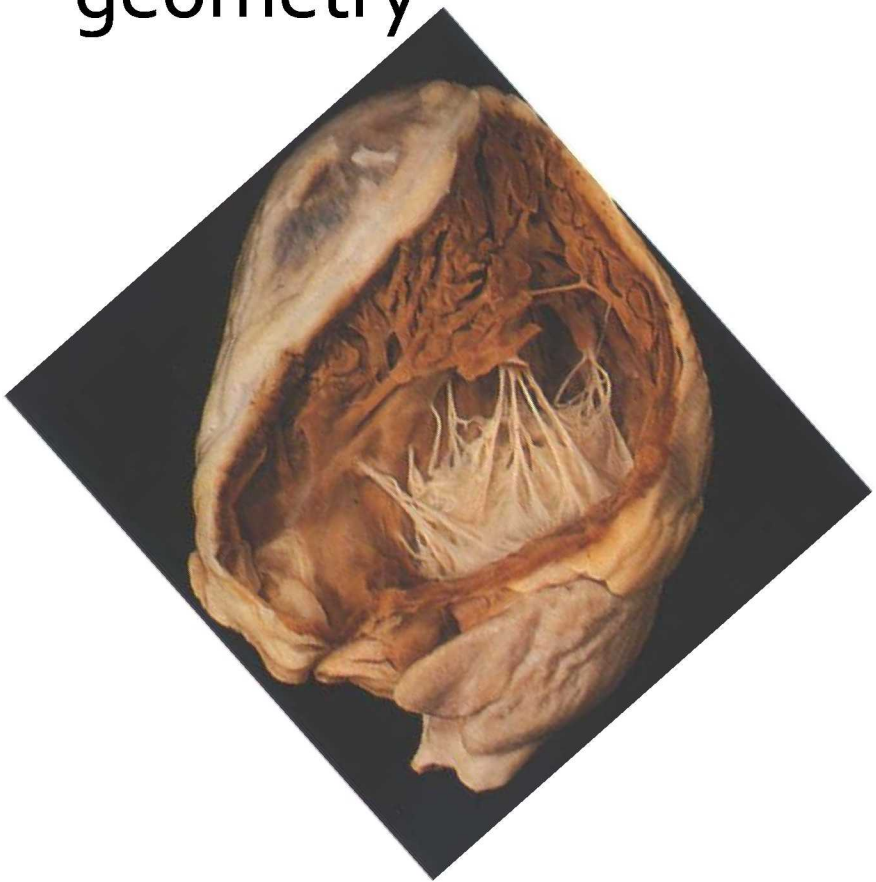
- First Right-Ventricle Tissue Doppler from ISS
- Subset of data from SDTO "Bracelet-M"
- Russian Countermeasure
  - Medical prevention strategy for reducing fluid shifts in microgravity in long-duration crew
  - Acute change in effective circulating volume

Physiology of the Right Ventricle

- Transpulmonary gradient of 5 mmHg to drive blood flow across pulmonary circulation
- RV contraction peaks early in systole (brief) drops rapidly
- RV ejection into a low-impedance pulmonary circulation
- RV diastolic volume 20-30% > LV despite lower diastolic pressure
- Compliant

Imaging difficulties

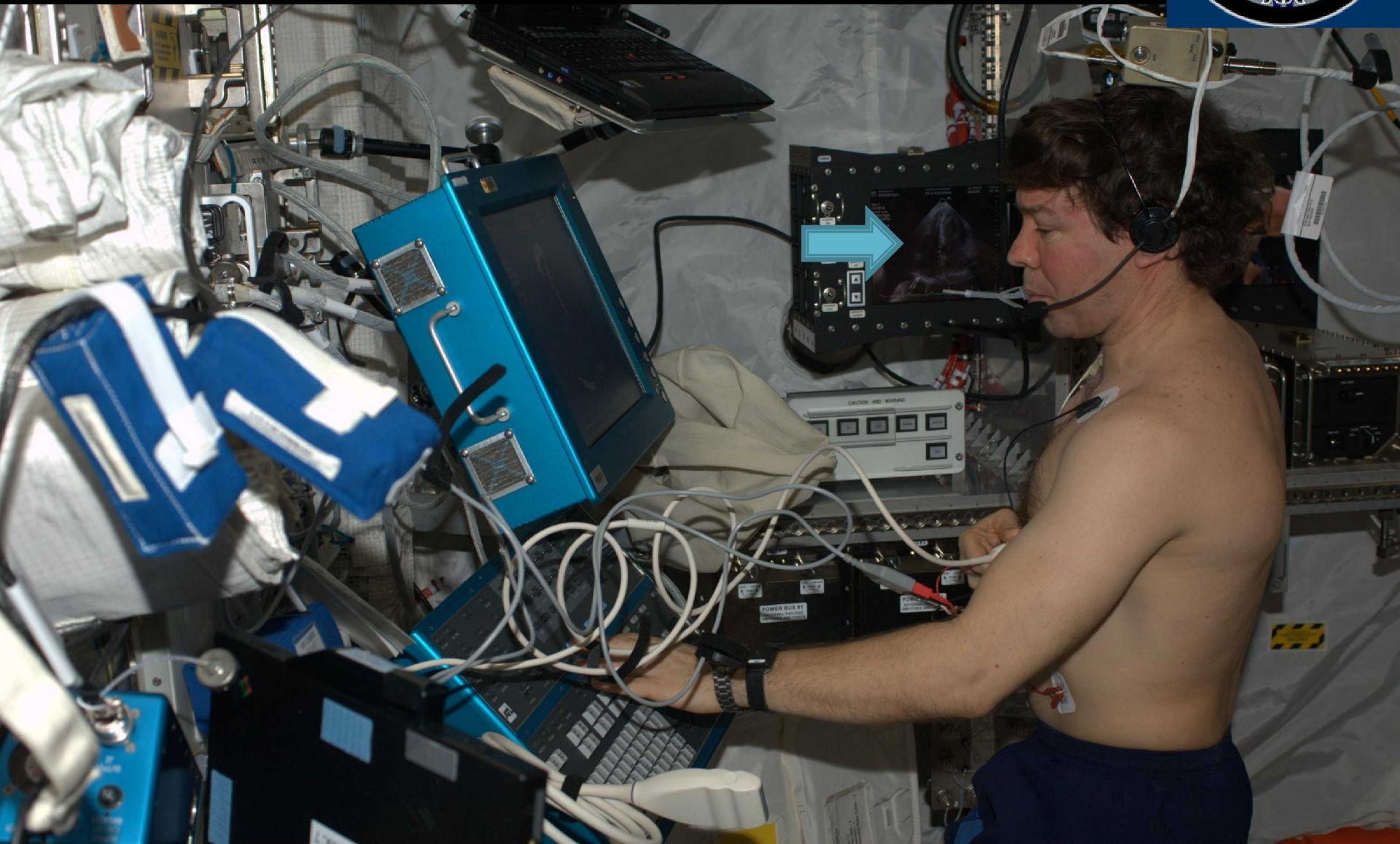
- Difficult to assess mass & volumes due to geometry




ACOLA
P4-2 A.Card/Gen
12:23:44
ATL

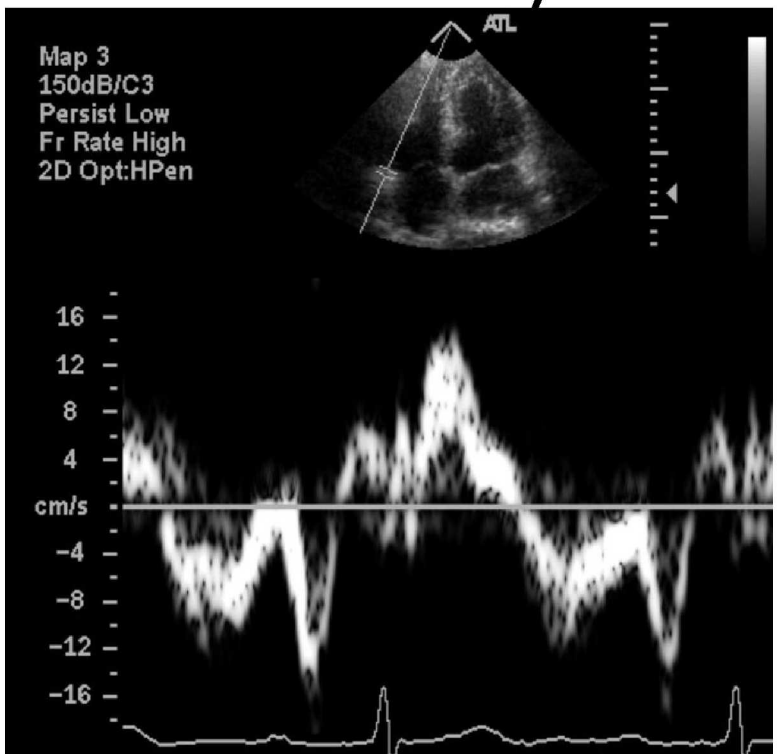
Methods

- Remote Guidance
  - Communication 1.8- to 2-second delay between operator on board the ISS and expert instruction mission control.
- Operator
  - Astronaut on colleague astronaut crewmembers
  - Operators utilizing a self-scanning technique
- Nine sessions with and without Braslet

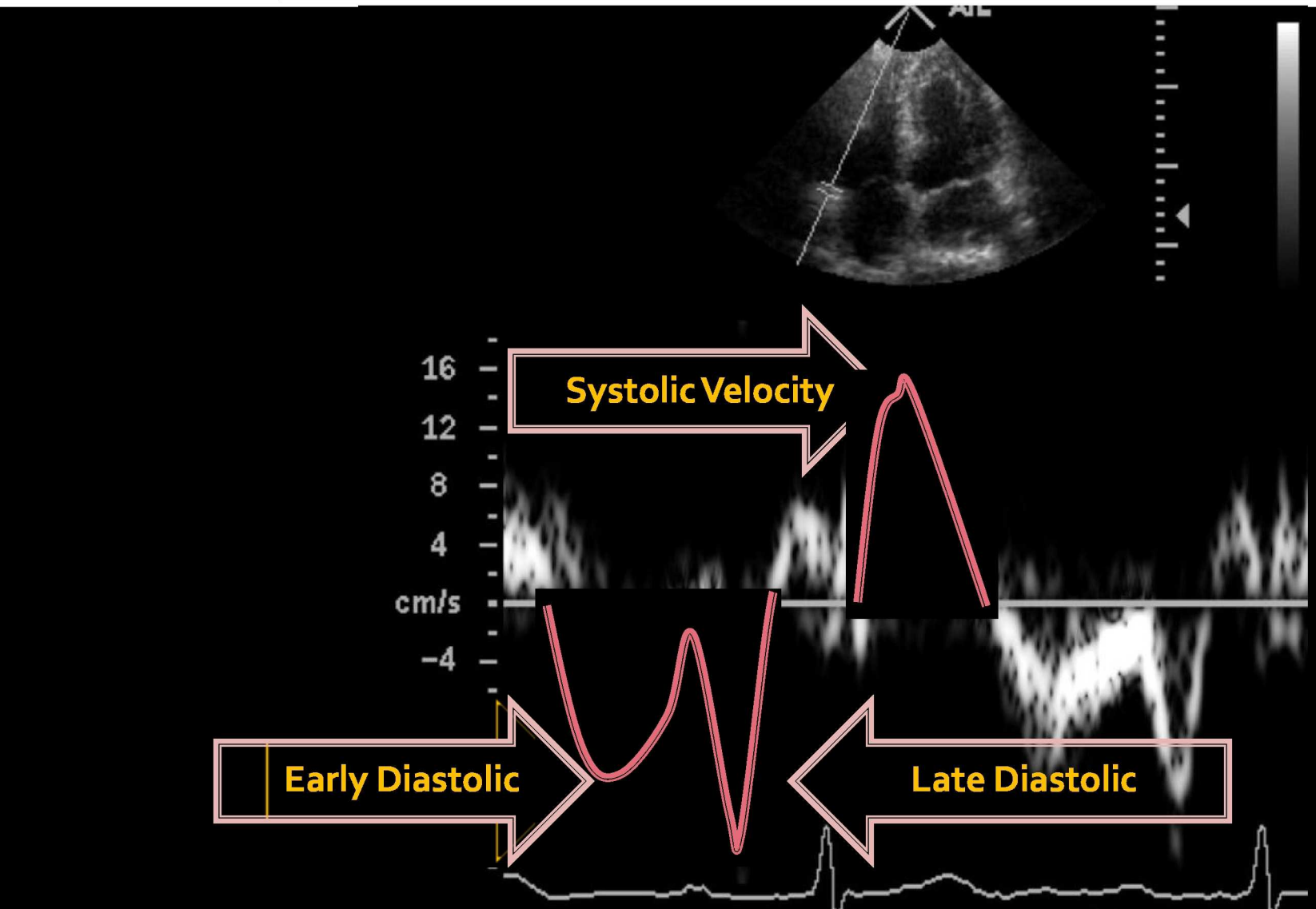

CAUTION AND WARNING
POWER BUS #1

Tissue Doppler Spectrum

- Tissue Doppler spectrum registers movement of a given sample of cardiac tissue throughout the cardiac cycle

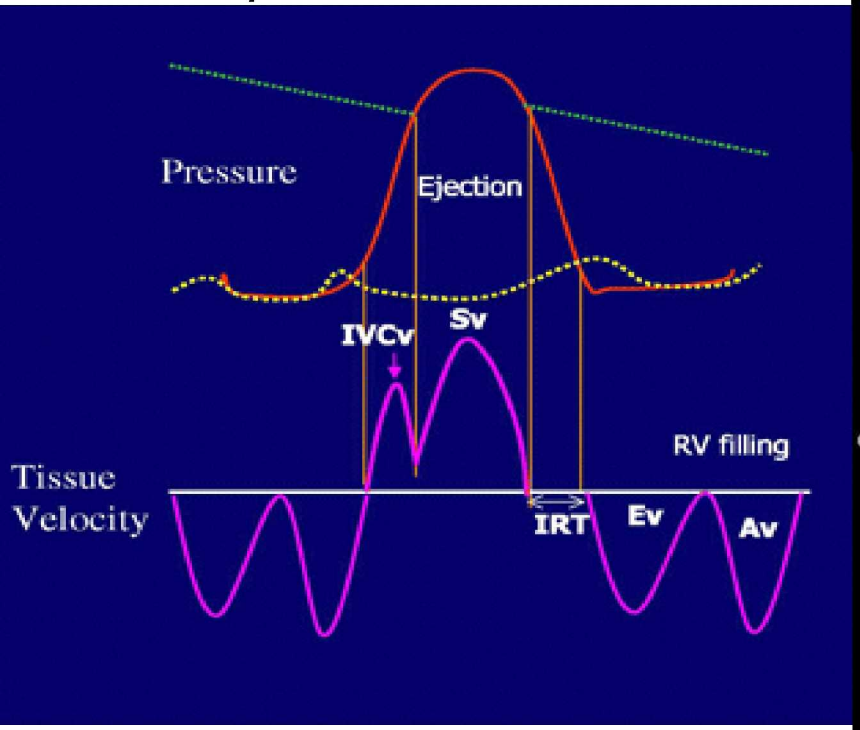


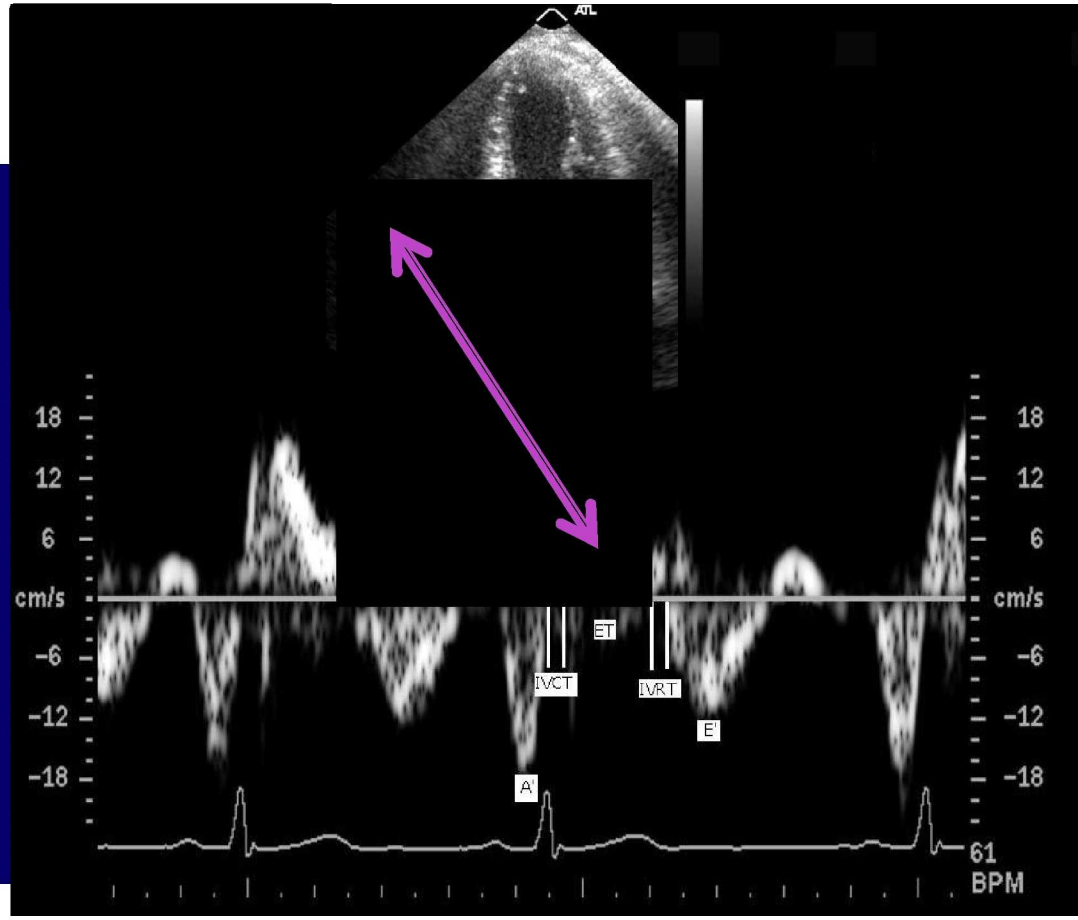
RV Tissue Doppler



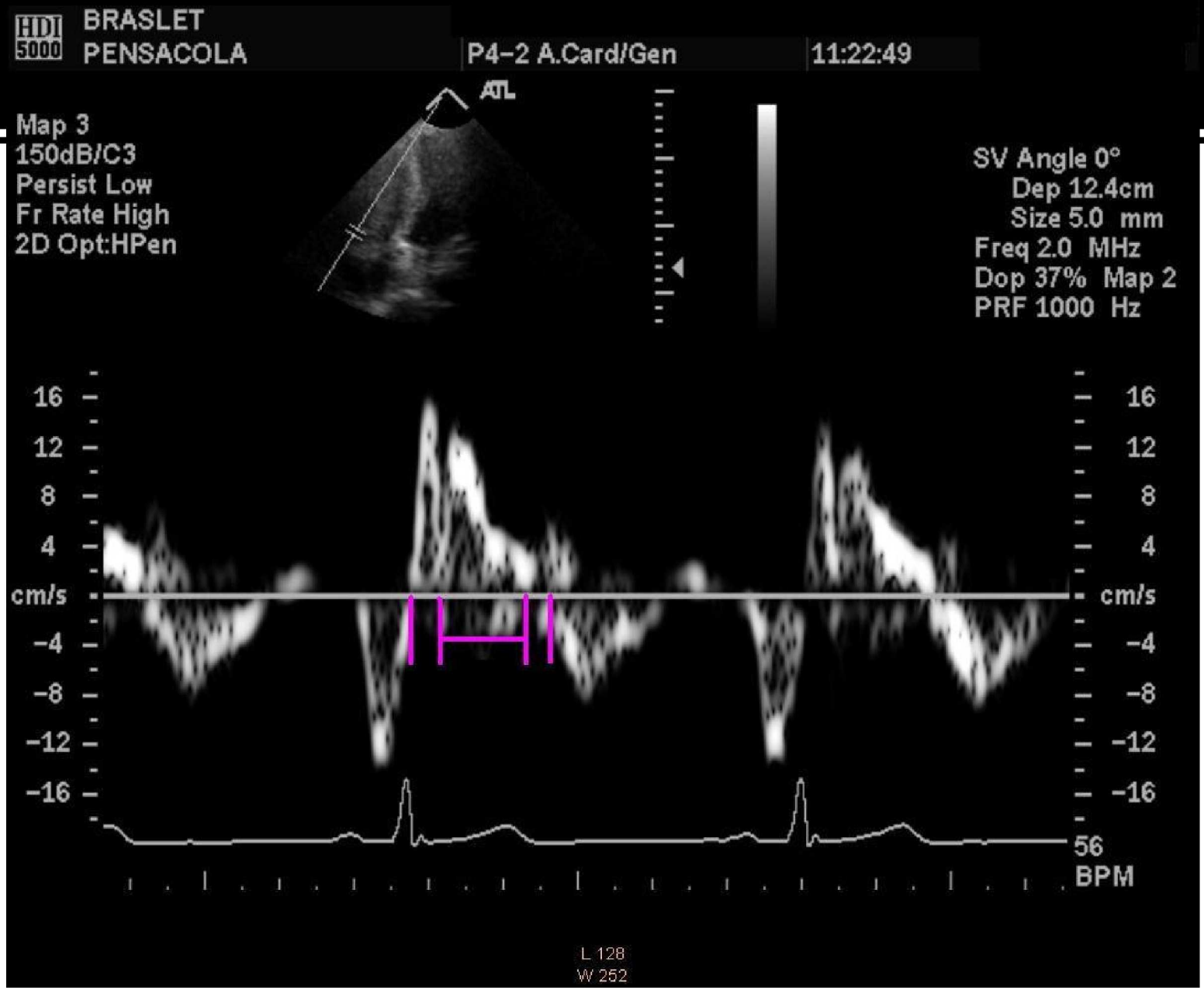
Rt Tei Index

- IVCT + IVRT / ET
- Myocardial Performance

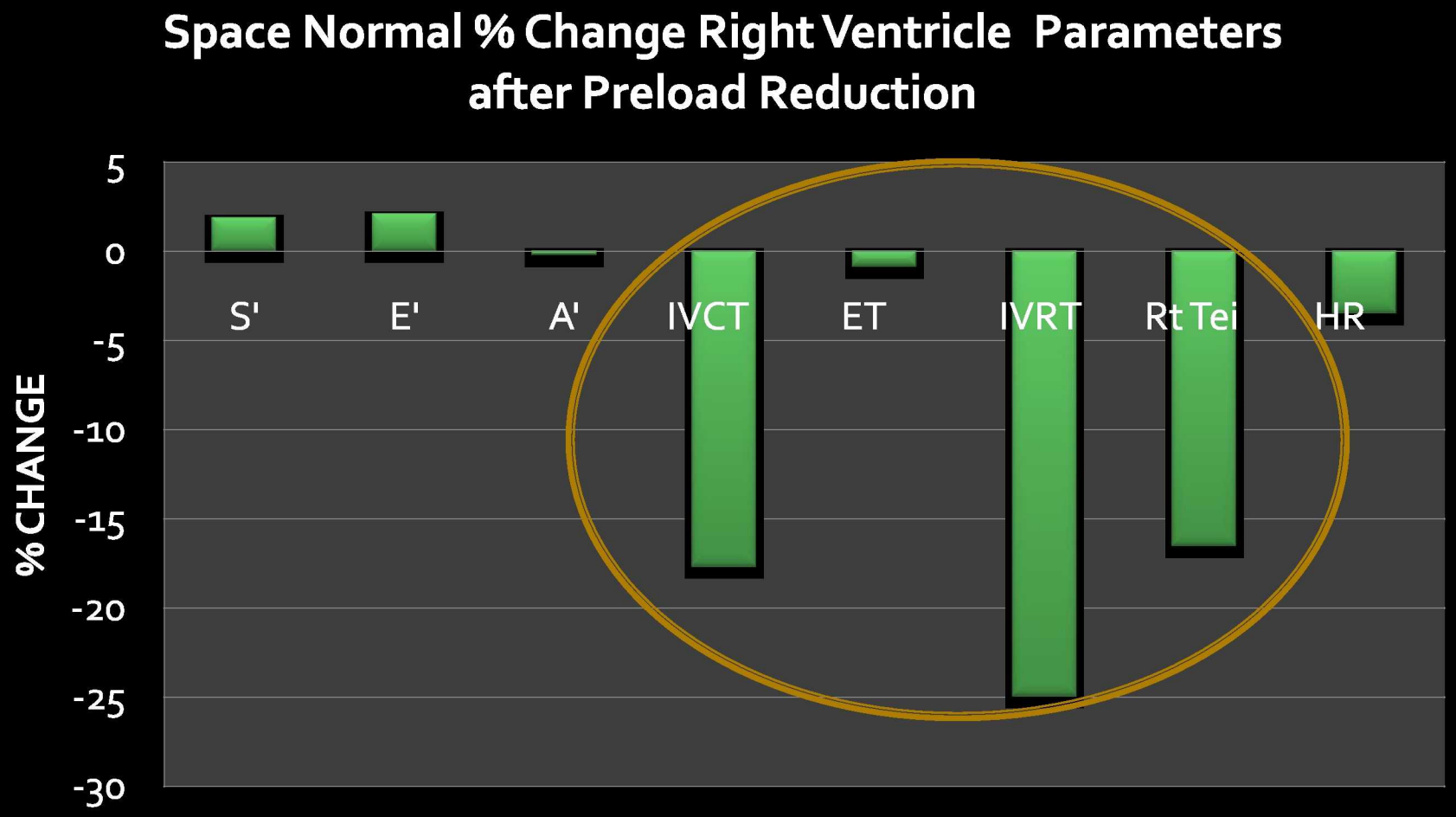




* Tei et al, Doppler Echocardiography Index for Assessment of Global Right Ventricular Function, J of A Soc. Echocardiography, 1996, vol.9, #6


HDI 5000
BRASLET
PENSACOLA
P4-2 A.Card/Gen
11:22:49
ATL
Map 3
150dB/C3
Persist Low
Fr Rate High
2D Opt:HPen
SV Angle 0°
Dep 12.4cm
Size 5.0 mm
Freq 2.0 MHz
Dop 37% Map 2
PRF 1000 Hz
16
12
8
4
cm/s
-4
-8
-12
-16
56
BPM
L 128
W 252

Summary of Results



Summary

- Unique data :acute preload change on RV
- Space Normal Tei index larger in microgravity than normal Tei index (< 0.3)
- Tissue Doppler can be performed by crew with high fidelity
- Need larger sample for better fidelity on Space Normal RV function
- More image data for RV Mass and Volume